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THE CONTROL OF THE CLOVER-FLOWER MIDGE



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TINY MAGGOTS IN red-clover flowers prevent the seeds from maturing and cause a great reduction in the seed crop. These maggots are the young of a very minute fly known as the clover-seed, or clover-flower, midge.

The farm practices by which this little pest can be controlled are light or close pasturing, early cutting, clipping, and soiling. These measures are explained on pages 7, 8, and 9.

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THE CONTROL OF THE CLOVER-FLOWER MIDGE

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WHY THE MIDGE SHOULD BE CONTROLLED

The clover-flower midge, or clover-seed midge,¹ (fig. 1) is a small mosquitolike fly which lays its eggs in the young clover heads. The tiny maggots hatching from the eggs destroy the seed-producing parts of the flower and injure the seed crop severely in many States throughout the red-clover sections of the country. This loss is almost entirely preventable by means described in this bulletin.

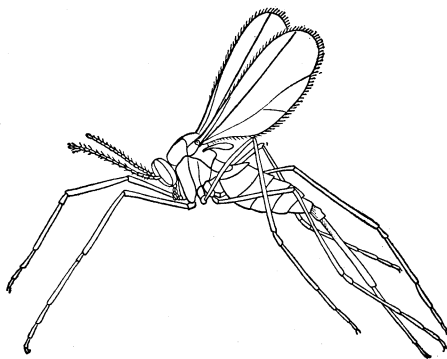


FIGURE 1.—The clover-flower or clover-seed midge, greatly enlarged.

DISTRIBUTION

Although the midge did not attract more than local attention until 1878 and was not described until a year later, there is considerable evidence that it was injurious in New England at least 30 years earlier. In the United States it probably occurs wherever mammoth, white, or the common red clovers are grown, and it is responsible for very heavy losses to the seed crop in most parts of the country where seed is produced.

FOOD PLANTS AND NATURE OF INJURY

Red clover is the chief food plant of the clover-seed midge. The midge is rarely found on either white or alsike clover and is never

¹ *Dasynura leguminicola* (Lint.); order Diptera, family Itonididae. The name "clover-seed midge" is now approved by the American Association of Economic Entomologists.

present on these plants in sufficient numbers to affect seed production.

This midge is injurious only in its larval, or maggot stage. It works in the flower (fig. 2), feeding upon those parts which normally would develop into seed. Although one maggot prevents the formation of only a single seed, the insects can make serious inroads on the seed crop when present in great numbers, as they usually are in infested fields.

The forage value of red clover is not impaired by midge infestation, and the insect is therefore of economic importance only in seed-growing districts.

SEASONAL DEVELOPMENT

WINTER

The midge passes the winter as a larva, generally in a silken case or cocoon on or slightly below the surface of the ground. Occasionally no cocoons are spun, especially where ample protection is afforded by the debris covering the surface of the soil. The cocoon is oval and very small, measuring approximately one-tenth inch in length and one-twentieth inch in diameter. It is constructed of a white paperlike substance and is very difficult to recognize in its natural location because of the coating of soil which causes it to resemble a small lump of earth.

SPRING

With the first warm days of early spring a few of the larvae in the cocoons begin to change to the pupal or resting stage, and within a short time the greater portion of the brood is in this stage. The pupal period during April and

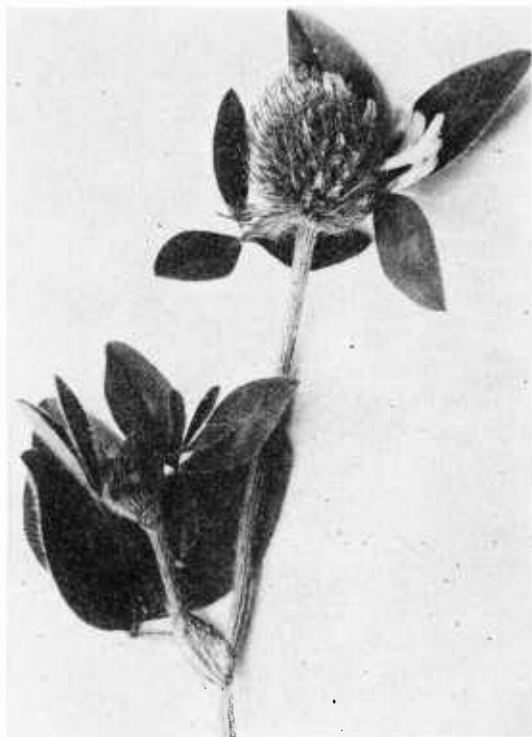


FIGURE 2.—Clover heads injured by the midge.

May lasts from 2 to 3 weeks, depending on the season. In seasons of an early spring a few midges complete their transformation and emerge as adults by April 21. If the season is late none may be found in the fields before May 5, or even later in some northern latitudes.

The adult fly (fig. 1) is smaller than a mosquito and of similar delicate structure. It is strikingly marked, the anterior half being black, with hair-fringed dusky wings, and the posterior half, or abdomen,

bright vermilion red in fresh specimens. The abdomen of the female is equipped with a long extensible egg-laying tube, or ovipositor, by means of which the eggs are inserted in the young clover heads. The male is more slender and fragile, and the shorter abdomen is equipped with a pair of clasping organs used in mating.

In a normal season, by May 5 young clover heads have begun to appear in noticeable numbers and midges are common. The maximum abundance usually is reached between May 18 and May 25. From this time on there is a gradual decrease in numbers until about the end of the first week in June, by which time the midges have become relatively scarce. Scattered individuals often are found, however, until the latter part of June.

Cool rains of several days' duration may check the emergence of new adults, and a corresponding increase in numbers may always be looked for during the fair weather immediately following such rains.

Upon emerging, the females, which are much more plentiful than the males, mate and proceed to the small green clover heads where they lay their eggs. They show marked preference for young clover heads which are just beginning to appear through the leaf sheath, but they frequently will select older heads provided they are still green.

The egg is oval, about three times as long as broad, and barely visible to the naked eye. It is pale yellow at first, but an internal orange spot appears just before the eggs hatch. Eggs are found both singly and in clusters, usually stuck to the hairs of the calyx (fig. 3) or to the calyx itself, but frequently in clusters of 10 to 20 just inside the leaf sheath, or on young leaves surrounding the head. A single midge has been observed to lay as many as 86 eggs, but it is probable that the average female actually lays 100 or more. It is not unusual to find considerably more than 100 eggs in and about a single head, or more eggs than there are florets. A midge generally spends only a few minutes on a head, placing a few eggs in one or two locations and then flying on to another.

The eggs hatch in from 3 to 5 days, according to the temperature. A larva upon hatching from the egg is pale yellow, with an internal bright-orange spot plainly visible. The young legless maggot wriggles to the top of the floret and forces its way inside through the unopened petals down to the young ovary, where it sucks the juices and thereby destroys the ovules, preventing the formation of seed. Occasionally two or more maggots are found in a single floret. A floret infested



FIGURE 3.—Eggs of the clover-seed midge fastened to hairs of calyx in immature red-clover flowers. Highly magnified.

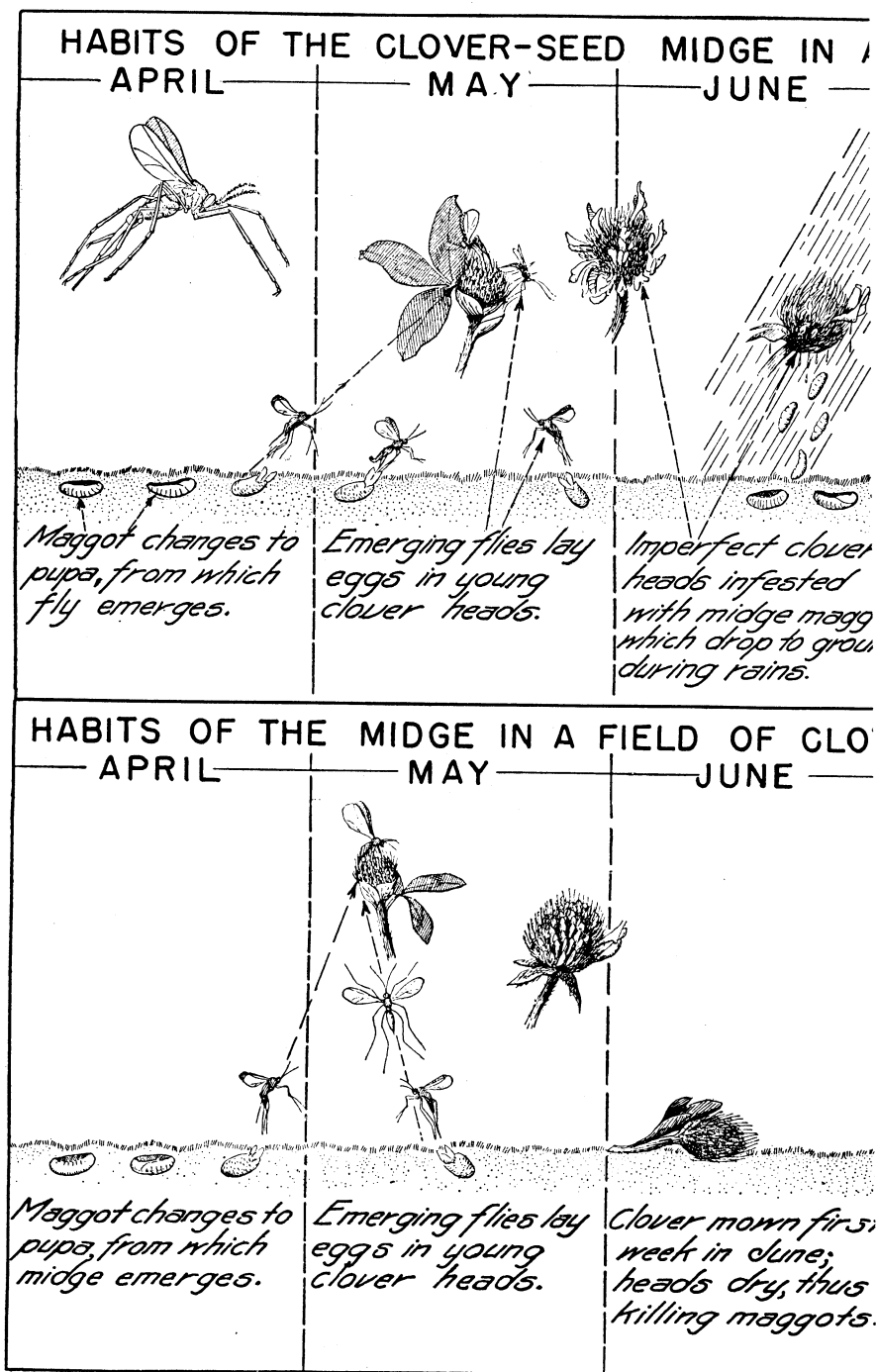
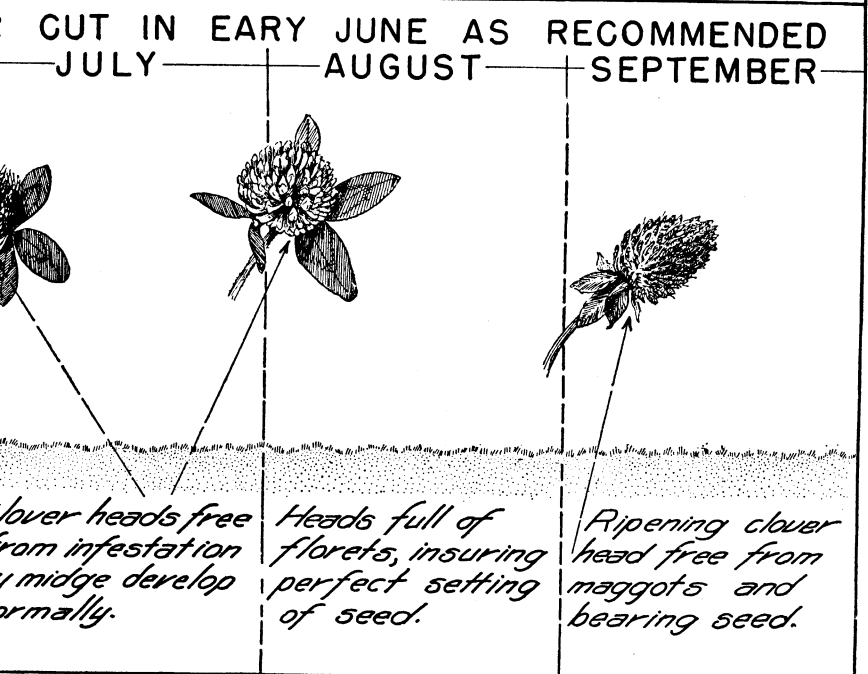
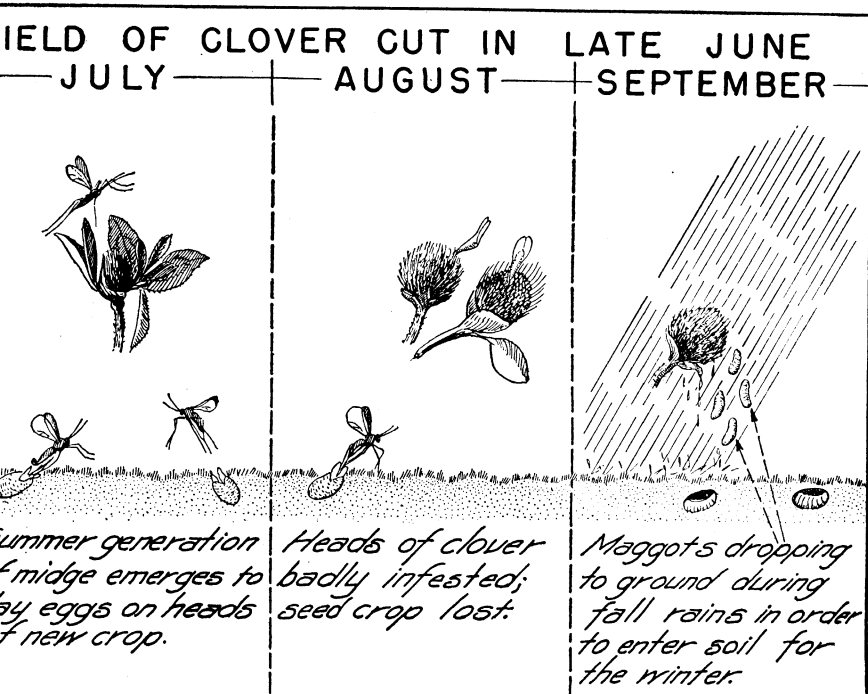


FIGURE 4.—Relation between time of cutting clover and c



ence of the midge. Cut early in June to avoid damage.

with a midge larva shows the injury very plainly, as the petals rarely expand. Infested heads are therefore distinguished easily, their imperfect blossoming giving them an irregular or mangy appearance. (Fig. 2 and cover illustration.)

A midge larva of the spring generation completes its growth in approximately 4 weeks. Few of them complete their development before the last of May, and if the season is exceptionally late full-grown maggots may not be found before the second or third week of June. The maggots grow rapidly while feeding in the florets, and change from a watery yellow to creamy white as they increase in size, and then to a salmon pink shortly before they become full grown. They are then about one-tenth inch long and entirely fill the florets, taking the place of the seed.

SUMMER

The mature maggots do not drop at once to the earth to pupate, but wait until rain has thoroughly moistened the clover heads and the surface of the ground. In some localities 2 or 3 weeks may elapse before there is sufficient rainfall to bring a midge brood out of the clover heads. After dropping out of the clover heads, the maggots work their way a short distance into the ground, where they spin cocoons similar to those in which the parent generation passed the winter. The maggots of the summer generation do not remain dormant in the cocoons but pupate at once. The pupal period at this season of the year is generally 2 to 3 weeks, but a spell of dry weather will often lengthen it, and a prolonged drought kills many of the larvae and pupae.

The first adults of the summer generation may be expected to appear in the fields between July 1 and 15. If there is a fair amount of rainfall, they emerge in constantly increasing numbers until about July 22. After this date there is a rapid decrease in numbers until about the middle of August, when very few are to be found. On the other hand, if there is no rainfall during July, this generation will be relatively scarce, reaching its height and disappearing by the middle of that month. Emergence would come in a later sequence in some localities. The adults of this generation lay their eggs in the young heads of the seed crop, where they hatch and develop as described for the spring generation.

LATE SUMMER AND FALL

The maggots of the summer generation also require approximately 4 weeks to mature. If the summer is dry, they frequently remain in the heads until the clover is hulled or, if the crop is left standing, until the fall rains occur. If sufficient rain falls during the late summer, however, they drop to the ground, and some pupate and emerge as adults during late August, September, and, occasionally, well into October. The adults of this third generation lay their eggs in the late heads in the fields from which they emerge. Most of their progeny have ample time to complete their growth before killing frosts occur. In any case sufficient progeny of either the second or third generation of midges survive the winter to emerge as adults and propagate the following spring.

CONTROL MEASURES

PASTURING

The practice of pasturing red clover previous to starting a seed crop has proved to be an effective means of midge control in the more northern latitudes. In favorable seasons clover often makes sufficient growth the first year to enable the farmer to begin pasturing early in the fall. Fall pasturing keeps down the volunteer heads in which the midge would otherwise secure a foothold in the field the first season. In any event, the clover always makes sufficient growth to permit pasturing the following spring. Spring pasturing exterminates the midge, either directly by destroying the clover heads containing the eggs and partially grown larvae, or indirectly by preventing the heads from forming while the adults of the spring generation are laying their eggs. The livestock may be removed from the field the latter part of May or early in June. In case the pasturing has not been close enough to get all the heads, a mower should be run over the field shortly after the stock is removed. This practice not only destroys the immature midge larvae which may be present in these heads, but also keeps down weeds.

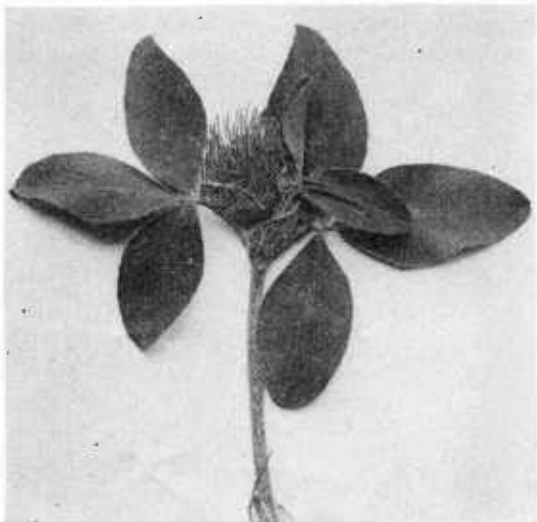


FIGURE 5.—Young clover head at stage when midge lays its eggs.

CUTTING

As the majority of farmers raise red clover for both hay and seed crops, they should cut the hay crop early in midge-infested districts. This practice destroys the first brood of maggots by cutting off and drying up their food supply, as shown in figure 4. To practice early cutting effectively the farmer must keep himself informed not only as to the development of the clover itself (fig. 5) but also as to the development of the midge larvae within the heads. The change in tint of the larvae in the infested heads from a creamy white to a salmon pink indicates that they are approaching maturity and that cutting should not be delayed long if the larvae are to be killed by this means. A cut with a sharp knife at right angles to the axis of growth of a clover head and a slight squeeze of the head will show whether the larvae have turned pink.

If the clover is cut about June 1, the maggots of the spring generation will be destroyed regardless of the season and an uninfested seed crop will be assured, except for a few scattered individuals that may invade the field from the roadsides or be blown over by the wind from a neighboring field. (See fig. 6.)

In most seasons, however, the clover can be cut with safety at a slightly later date than June 1 in the more northern latitudes. This enables the farmer who is willing to assume the risk of unfavorable weather to obtain a greater amount of forage from his field than would be possible otherwise. This later cutting is usually effective because midge larvae, after completing their development, do not leave the clover heads and drop to the ground to pupate until the florets have become thoroughly moistened. If, therefore, the hay crop is cut and removed from the field any time after the first week in June and

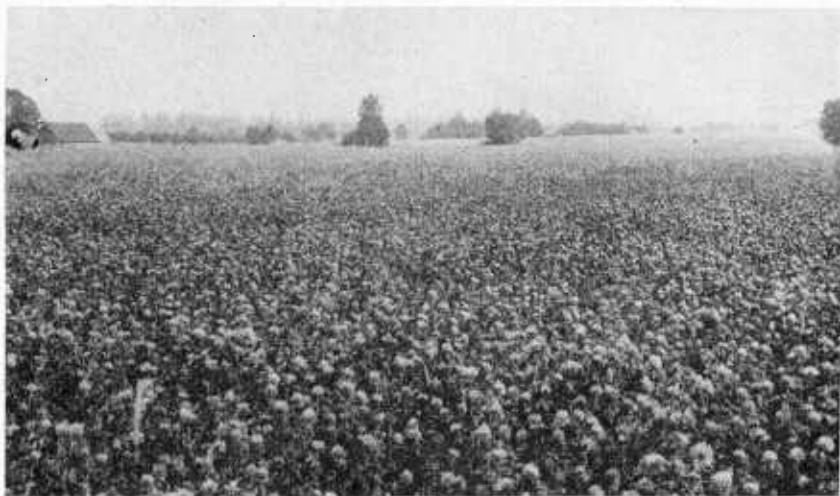


FIGURE 6.—Field of clover from which the hay crop was cut June 1. The perfect blossoms show that they are free of the midge.

before the first rainfall of more than one-tenth inch, the control will be fully as effective as when the crop is cut while the maggots are still immature.

A good rule to follow is to cut the hay crop early in June provided the weather is favorable. If it is rainy during that period, wait and cut the crop as soon as the sky clears and the weather becomes settled. In any case it is best to cut for hay before any of the clover heads turn brown.

CLIPPING

Farmers in some localities who desire neither to pasture nor to obtain a hay crop clip their clover back between May 10 and May 25, leaving the clippings on the ground as a mulch. In fields clipped May 15 or earlier, however, the seed crop is liable to be infested with the midge, because the clover makes sufficient growth to produce heads early in June before the adult midges of the spring generation have disappeared. It is a safe rule not to clip earlier than May 20. Clover

clipped at about this time will not produce young heads until after the adults of the spring generation are gone, and these heads will be far enough advanced by July 1 to be immune from attack by any of the adults of the summer generation.

SOILING

A few farmers who combine clover-seed production with dairying find it desirable to cut their clover and feed it green during the spring and early summer. This practice, known as soiling, affords an effective means of controlling the midge, provided the clover is held back sufficiently to prevent young heads of the seed crop from developing before the middle of June. Where the clover has been cut late in April or early in May, it may be necessary to cut it a second time about June 1.

